Bands IV. and V. were identified beyond any doubt by their proximity to the line λ 5527, of the magnesium spectrum and Band VII. (Dunér's Band 8), by its neighbourhood to the double line of air λ 5003, and it was clear that they occupied their usual places. These were measured in the spectrum of *β Pegasi*, on the occasion above referred to, as λ 5610, λ 5450, and λ 4953. The dark line on Band VI., the wave-length of which was measured in the spectrum of *β Pegasi* as λ 5272 (Dunér's Band 6), was not identified, but Band VI. was so broad that it probably embraced this line or sub-band within its limits. A band was also seen at D, without doubt Band II., λ 5869 (Dunér's Band 3), and another beyond F, probably Band VIII., λ 4761 (Dunér's Band 9). Band I., λ 6169 (Dunér's Band 2), was only just suspected. The spectrum was not traced far enough for bands to be detected beyond these, either towards the red or the violet. Some feeble bands or lines were suspected between Bands V. and VI., but none of the great bands were resolved into lines. The *breadth* of the great bands seemed to be about the same as usually observed in stars of this type. The dark line or narrow band at λ 5272 is often confused with Band VI., and the breadth of the latter was not greater than would result from this cause.

Royal Observatory, Greenwich:
1886, *January* 6.

Changes in the Red Spot on Jupiter. By W. F. Denning.

It may be interesting to record and compare some of the visible changes which have occurred in the aspect of this remarkable formation; and with this end in view I send the accompanying drawing of the appearances observed in my 10-inch Reflector on several occasions since 1880.

A brief *seriatim* description of the most noteworthy features and variations of the spot and region near will be sufficient for the present purpose. A discussion of the phenomena in their physical relations would only be premature pending the further accumulation of records. In each case the spot was delineated at mid transit.

1. 1880, Nov. 19, $9^h\ 23^m$.—Red spot very dark and definite in outline with minute black speck at following end. N. of the centre the white equatorial spot is seen, the two markings being in conjunction.

2. 1881, Sept. 28, $13^h\ 11^m$.—The spot very red and conspicuous, with small black marks at E. and W. extremities. Immediately N., and slightly preceding, the white equatorial spot is observed with its normal light-trail running to N.E. and confused with other irregularities on the equator. N. of the following end a very curious narrow, curved belt, of red colour,

is traced emerging from the great S. belt and running parallel with it far to E. This feature was also visible in 1880, Sept., though it afterwards faded, and a detail of very similar character and position is figured by Mr. Gledhill near his ellipse of 1869–70.

3. 1881, Dec. 7, $10^h\ 40^m$.—Red spot evidently fading in the central part, though the elliptical outline remains equally bold, especially on the N. side, where it abuts great S. belt. The black specks at the longitudinal limits of the spot are still very obvious, and the bent belt N. of the following end now appears much plainer than before. Several large irregular white patches lie near equator, and there is a singular alternation of oval white and dark markings on a belt closely outlying the spot on its S. side.

4. 1882, Oct. 30, $16^h\ 10^m$.—The spot very much fainter generally, though still a fairly prominent object on the planet's surface. The decadence has chiefly affected the central region; the dark ends are still apparent, and the integrity of form is not disturbed. The bent belt N. following has further developed: it is broader, and the red colour more conspicuous. It has now extended itself so much as to completely environ the planet, and where it comes up to the N. preceding end of the red spot, it suddenly dips N., and merges into the great S. belt, so that the appearances near the spot's following end are here repeated, and the effect is a symmetrical jointure of the two belts relatively to the red spot. The white equatorial spot is shown N. of the following side, but the variegated belt just S., seen in Dec. 1881, is gone.

5. 1883, Oct. 15, $15^h\ 37^m$.—Red spot very faint and apparently of nearly uniform tone. The bent belt has now become a very prominent feature, and forms a basin in which the red spot rests, though perfectly detached. Indeed, the region separating them is very bright, as if the lucid zone in the same latitude as the red spot ran N. to avoid contact. The shoulders of the bent belt are very dark, but there is rather an absence of other detail.

6. 1884, Feb. 6, $9^h\ 29^m$.—Spot very faint, though under good definition it is well seen. A striking feature now arrests the eye in the form of a narrow dark belt which is actually connected with the spot on S. following side. Though the N. belt has avoided the spot so persistently, here is a belt curving down right into the spot! The fact is very interesting, and goes far to prove that the bright belt, in curving down to avoid commingling with the red spot, carries the faint S. belt with it, and thus reproduces a parallel formation to the bent belt on the spot's N. following side. This junction of the belt and spot was observed in Jan. and Feb. 1884, by several other observers independently. The sketch shows a white equatorial spot (though not the one so frequently observed), and the narrow bright line which is now all that divides the new and old S. belts.

7. 1885, Feb. 25, $12^h\ 50^m$.—The red spot is but a mere skeleton of its former self. It exists only in outline, and reminds

one forcibly of Gledhill's ellipse. There is a dusky belt, not smooth in tone, immediately S., and several white spots are seen in the usual position on the inner margin of the great S. belt. The bent belt on the N. following side of the spot is still very dark, but the opposite side has faded greatly. All the interior region of the red spot seems involved in a white cloud, which has, however, quite failed to break its continuity of outline. Contemporary with the virtual obliteration of the spot's central area, the line of the ellipse appears much plainer, as if gaining in prominence. The following end is darkest.

8. 1885, May 9, 8^h 8^m.—Red spot has become very much plainer, and the interior light cloud appears nearly dissipated. The following end of the spot is very dark, and shows the black spot noticed in previous years. There is a narrow dark belt distinctly bent down from the spot's S.W. side, and actually connected with it. Some distance further S. there is a very dark broken belt. A white spot is figured N. of the preceding side of the red spot, and the marked decadence of the bent belt on its N. preceding margin, noticed in Feb. 1885, has become more decided. It is now very narrow and faint; it seemingly exists in duplicate on the S. preceding region of the spot. Definition very superb when these details were observed.

As to the present aspect of the red spot, it does not differ essentially from that portrayed in fig. 4 for 1882, Oct. 30. Relatively to its appearance in 1879, '80, and '81, it is faint and shorn of its striking character. But it is much more distinct than in 1883 or 1884; the enclosed light cloud is gone, and the red ellipse of the preceding winter (1884–5) has become diffused into an oval marking similar to that which the spot assumed more than three years ago. I have obtained the following observations during the present apparition:—

Date.	Spot central. h m	Date.	Spot central. h m
1885 Oct. 24	17 32	1885 Dec. 28	16 21
26	19 10	1886 Jan. 2	15 29
Dec. 1	19 0	4	17 6
9	15 40		

These times prove that the rotation period of 9^h 55^m $38^s{\cdot}99$ (=870°·31 Daily rate) adopted by Mr. Marth in his Ephemerides (*Monthly Notices*, vol. xlv. No. 9) corresponds very closely indeed with the present motion and position of the spot. His predicted times based on this rate show an average difference of less than two minutes with the observed times as above. According to my observations here, the spot has exhibited an equable motion since the summer of 1882 (after becoming so much fainter), the mean period being 9^h 55^m $39^s{\cdot}1$. My comparative rotation periods were:—

Dates of Limiting Observations.	No. of Rotations.	Period. h m s
1882 July 29–1883 May 4	674	9 55 39·1
1883 Aug. 23–1884 June 12	710	9 55 39·1
1884 Sept. 21–1885 July 8	700	9 55 39·2

As far as the observations have already progressed during the present opposition, I find the period $9^h\ 55^m\ 40^s{\cdot}3$ from 174 rotations, but the interval of 72 days is too short for good results.

As to the new red spot, so frequently observed during the last opposition and following the old spot $1^h\ 48^m$ ($=65°{\cdot}3$) in the same latitude, I looked for it most carefully before sunrise on January 5, but failed to recover it. It has either disappeared altogether or become extremely faint, like the belt on which it is projected.

Note on the Biela Meteors. By Richard A. Proctor.

At the last meeting of the Society a remark was made to the effect that the radiation of the Biela meteors from an area, instead of a point, might be regarded as affording evidence in favour of a theory propounded by an anonymous writer in the *Times*, who, in an essay on comets and meteors, had maintained that the Biela meteors were probably ejected from the earth. As the author of the article in question, I desire to point out that it has never occurred to me to regard the meteors following Biela's comet as earth-born bodies. I have never heard of anyone who has suggested that they may have been so; nor can I imagine that any astronomer of repute would fail to recognise the overwhelming objections against such a theory. The article referred to definitely mentioned the Biela meteors as probably sprung from Jupiter.

The wide area of the radiant region, by the way, is no new phenomenon. It is interesting as showing how untenable is the belief that a radiant region of small area—not more than two degrees in diameter, for example—can safely be assigned to meteors having the so-called stationary radiants. So soon as the radiant regions of these systems come to be dealt with by several observers, it will be found that they are much larger than has been supposed. All occasion for the assumption of very great velocities will then disappear; nor need the laws of geometry be rejected for the sake of stationary radiant regions, as distinguished from radiant points.

The wide area appears to me to be unquestionably due to changes of direction caused by atmospheric resistance. If this affects meteors falling at the same time in originally parallel streams on the same region of our air, much more must it affect meteors falling in different months.

Barrow-in-Furness:
1886, *January* 6.